United States
Environmental Protection
Agency

EPA530-R-10-011
October 2010

National Priority Chemicals Trends Report (2005-2007)

Section 4
Trends Analyses for Specific Priority Chemicals (2005-2007): Dioxin and Dioxin-Like Compounds (Dioxin)

Program Implementation and Information Division
Office of Resource Conservation and Recovery
U.S. Environmental Protection Agency

Contact Information:

Bill Kline, Senior Data Analyst
Information Collection & Analysis Branch
(540) 341-3631
kline.bill@epa.gov

Tammie Owen, Data Analyst
Information Collection & Analysis Branch
(703) 308-4044
owen.tammie@epa.gov

Dwane Young, Chief
Information Collection & Analysis Branch
(703) 347-8578
Young.dwane@epa.gov

Dioxin and Dioxin-Like Compounds (Dioxin)

Chemical Information

Dioxin refers to a group of chemical compounds that share similar chemical and biological properties. Several hundred of these compounds exist and are members of two closely related families: chlorinated dibenzo-*p*-dioxins (CDDs) and chlorinated dibenzofurans (CDFs). The dioxin and dioxin-like compounds category (TRI Category N150) consists of 17 specific CDD and CDF compounds reportable to TRI.

Chemical Name	Abbreviated Name
chlorinated dibenzo−*p*−dioxins (CDDs)	
2,3,7,8-tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD
1,2,3,7,8-pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin	1,2,3,4,6,7,8,9-OCDD
chlorinated dibenzofurans (CDFs)	
2,3,7,8-tetrachlorodibenzofuran	2,3,7,8-TCDF
1,2,3,7,8-pentachlorodibenzofuran	1,2,3,7,8-PeCDF
2,3,4,7,8-pentachlorodibenzofuran	2,3,4,7,8-PeCDF
1,2,3,4,7,8-hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF
1,2,3,4,6,7,8,9-octachlorodibenzofuran	1,2,3,4,6,7,8,9-OCDF

General Uses: CDDs and CDFs are not commercially produced, except in small quantities for chemical analyses and toxicological research. CDDs and CDFs are formed as unwanted byproducts when chlorinated materials are involved in combustion or other high-temperature processes, such as waste incineration, energy generation, metallurgical processes, chemical manufacturing and other industrial processes. Metallurgical processes that may release CDD/CDFs include ferrous sources, such as iron ore sintering, coke production, and the production of steel in electric arc furnaces from scrap feed. Secondary aluminum, copper, and lead smelters can also be sources of CDD/CDFs. CDDs and CDFs can also be formed as unintended byproducts of manufacturing processes. For example, they are generated in pulp and paper mills during chlorine bleaching.

NOTE: Dioxins are generally produced and released by industrial processes in relatively small quantities compared with the quantities of other TRI-listed chemicals produced and released. Because of this, and the fact that certain dioxins are toxic at very low levels of exposure, a much lower TRI reporting threshold was established for dioxins (0.1 gram per year). Therefore, facilities report dioxins to TRI in grams. For the purposes of this section, we present our trends analyses using grams, rounded to the nearest whole gram. Please note that most of the dioxin quantities in the database are expressed in terms of very small quantities—even up to seven decimal places. In rounding the quantities to the nearest whole gram, certain quantities will appear to be zero. We made this conversion to facilitate our trends analyses. However, rounding these quantities to the nearest whole gram should not be interpreted as minimizing the importance of smaller quantities of dioxin—which are of considerable concern.

In addition, elsewhere in this document, where analyses of trends for aggregated quantities of PCs are presented, we converted the quantities (grams) of dioxin to pounds (using 454.5 grams per pound) and rounded these quantities to the nearest whole pound. We made this conversion to provide uniformity and consistency in the quantities used to perform analyses of trends at the more aggregated levels. Again, this conversion and rounding should not be interpreted as minimizing the potential health effects associated with smaller quantities of dioxin.

How Much Dioxins Were Generated?

For 2007, 363 facilities reported approximately 204,000 grams of dioxins were generated. Eight facilities reported approximately 90 percent of the national total quantity generated of this PC. Compared to the total quantities of dioxins reported for 2005 and 2006, the quantity decreased by approximately 14,700 grams and decreased by approximately 20,800 grams, respectively (Exhibit 4.8).

Exhibit 4.8. National Generation of Dioxins (2005−2007)

TRI Reporting Year	2005	2006	2007
Total Quantity of Dioxins (grams)*	218,974	224,897	204,114
Number of TRI Facilities Reporting Dioxins	376	366	363

* Facilities report dioxin and dioxin-like compounds to TRI in grams, with a reporting threshold of 0.1 grams. For the purposes of this table, we rounded the quantity reported to the nearest whole gram.

Where Were Dioxins Generated?

For 2007, facilities in 42 states reported generating dioxins (Exhibit 4.9). From 2005 to 2007, facilities in EPA Region 6 reported most of the dioxin quantity generated, with Louisiana and Texas facilities accounting for approximately 47 percent and 35 percent, respectively.

Exhibit 4.9. Location of Facilities that Generated Dioxins (2007)

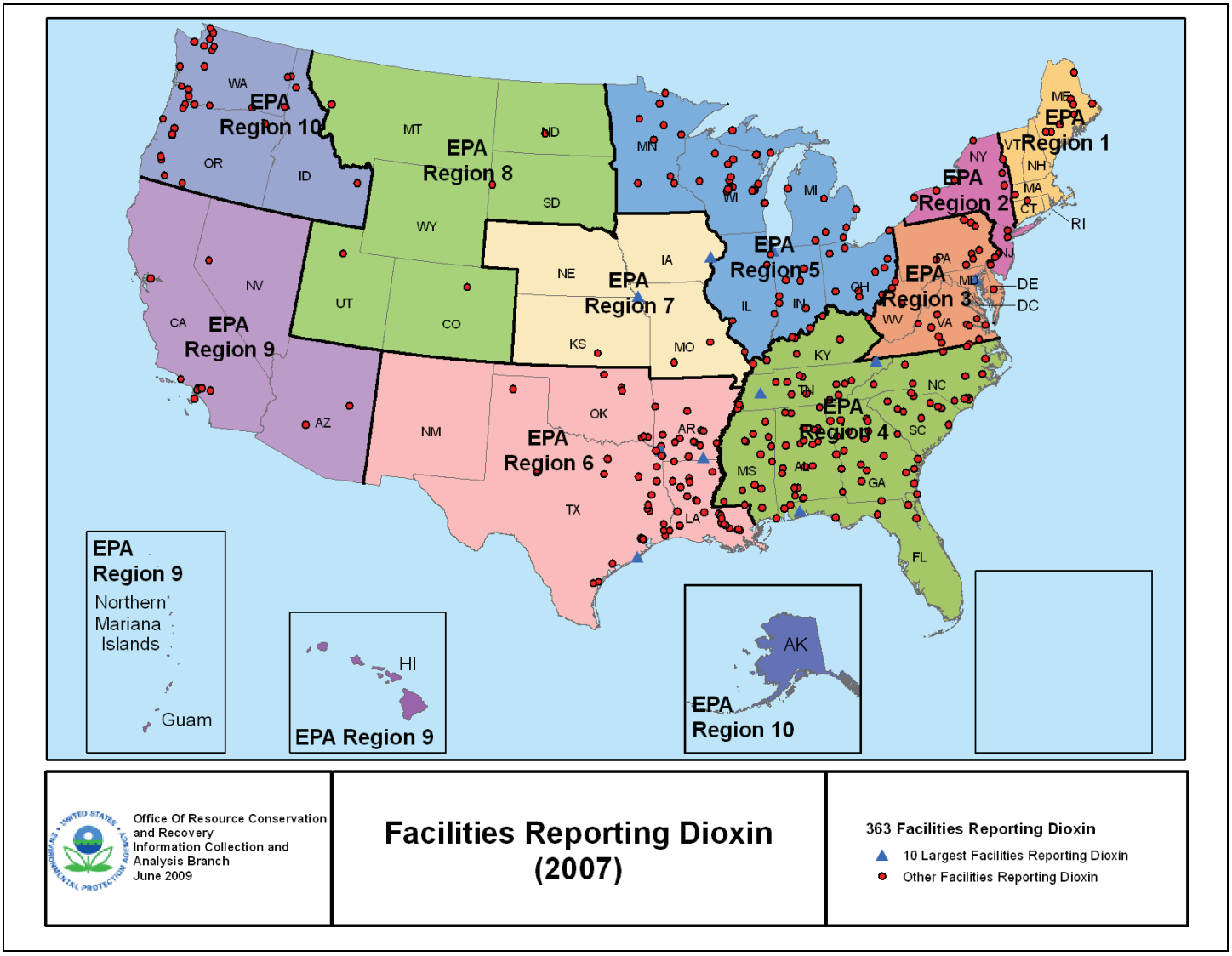

Exhibit 4.10 shows the counties in which facilities reported approximately 98 percent of the total quantity of dioxin generated for 2007. In Harris County, Texas, two organic chemical manufacturing facilities (same company) accounted for most of the approximately 25,000 gram increase in 2006. The facilities attributed the increased quantity of dioxin to operational issues - it had to transfer material off site due to a byproduct reactor being down, while the other facility noted an increase in the quantity of heavy ends received from sister facilities for incineration. One of these facilities also had an increase of approximately 37,000 grams in 2007. A petroleum refinery located in Iberville County, Louisiana reported decreases of approximately 19,000 grams and 33,000 grams for 2006 and 2007, respectively.

Exhibit 4.10. Quantity of Dioxins, for Facilities Reporting 98 Percent of Total Quantity, by County (2007)

EPA Region	State	County	Quantity (grams) of Dioxins			Percent of Total Quantity (2007)
			2005	2006	2007	
6	TX	Harris	16,852	42,049	79,251	38.8%
6	LA	Iberville	102,656	83,724	50,737	24.9%
5	MI	Midland	14,658	30,998	22,086	10.8%
6	LA	Calcasieu	22,195	23,882	19,621	9.6%
6	TX	Brazoria	17,357	16,431	9,940	4.9%
6	TX	San Patricio	6,532	6,302	6,631	3.2%
4	TN	Blount	2,210	2,510	3,051	1.5%
4	KY	Marshall	2,068	1,363	2,324	1.1%
4	SC	Florence	1,092	1,650	1,305	0.6%
4	MS	Grenada	18,157	2,003	1,293	0.6%
4	KY	Hancock	590	860	1,040	0.5%
5	IN	Wabash	898	1,048	783	0.4%
3	WV	Marshall	428	432	423	0.2%
6	LA	Ascension	3,422	3,526	406	0.2%
5	WI	Sheboygan	95	129	372	0.2%
4	NC	Brunswick	1,262	1,186	372	0.2%
6	LA	Rapides	941	722	268	0.1%
		Total	**211,412**	**218,816**	**199,904**	**97.9%**

Which Industries Generated Dioxins?

For 2007, facilities in 42 NAICS codes reported dioxins. Exhibit 4.11 shows the 8 industries in which facilities accounted for approximately 99 percent of the dioxins generated. Facilities in three of these industries reported 89 percent of the dioxins generated.

Exhibit 4.11. Industry Sectors Quantities of Dioxins, for Facilities Reporting 99 Percent of Total Quantity (2007)

Primary NAICS code	NAICS Code Description	Number of Facilities Reporting (2007)	Quantity (grams) of Dioxins			Percent of Total Quantity (2007)
			2005	2006	2007	
325199	All Other Basic Organic Chemical Manufacturing	8	18,208.8	73,538.5	103,354.8	50.6%
325211	Plastics Material and Resin Manufacturing	14	5,417.0	5,758.9	50,852.3	24.9%
325181	Alkalies and Chlorine Manufacturing	12	36,645.4	36,405.0	27,593.8	13.5%
325320	Pesticide and Other Agricultural Chemical Manufacturing	5	21,871.8	7,148.1	6,902.3	3.4%
321114	Wood Preservation	21	24,511.7	7,833.9	4,572.9	2.2%
325110	Petrochemical Manufacturing	7	4,750.7	5,479.4	3,260.0	1.6%
331312	Primary Aluminum Production	2	2,209.8	2,510.3	3,050.9	1.5%
331314	Secondary Smelting and Alloying of Aluminum	33	2,766.1	3,009.2	2,958.5	1.4%
	Total	**102**	**116,381**	**141,683**	**202,546**	**99.2%**

How Did Facilities Manage Dioxins?

Exhibit 4.12 shows how facilities, by industry, managed dioxins in 2007.

Disposal: Facilities disposed of, primarily off site, approximately 35 percent of the dioxins generated.

Energy Recovery: Facilities reported using energy recovery for 0.6 percent of the dioxins generated.

Treatment: Facilities treated, primarily on site, approximately 65 percent of the dioxins generated.

Exhibit 4.12. Management Methods for Dioxins in Industry Sectors (2007)

Primary NAICS Code	NAICS Code Description	Total PC Quantity Reported	Quantity (grams) of Dioxins					
			Disposal		Energy Recovery		Treatment	
			On-site	Off-site	On-site	Off-site	On-site	Off-site
325199	All Other Basic Organic Chemical Manufacturing	103,354.8	2,886	56,260	0	0	34,351	9,857
325211	Plastics Material and Resin Manufacturing	50,852.3	55	367	0	3	23,306	27,122
325181	Alkalies and Chlorine Manufacturing	27,593.8	2,456	186	0	0	21,827	3,125
325320	Pesticide and Other Agricultural Chemical Manufacturing	6,902.3	0	6,771	0	1	0	130
321114	Wood Preservation	4,572.9	0	233	0	1,227	405	2,708
325110	Petrochemical Manufacturing	3,260.0	0	200	0	0	523	2,537
331312	Primary Aluminum Production	3,050.9	0	11	0	0	3,040	0
331314	Secondary Smelting and Alloying of Aluminum	2,958.5	89	848	0	0	2,021	0
	Total	**202,546**	**5,486**	**64,877**	**0**	**1,231**	**85,474**	**45,479**

Data Derived From Hazardous Waste Biennial Reports for Dioxins

In this section, we present data about dioxins contained in hazardous wastes, derived from information submitted by facilities in Biennial Reports under RCRA. We derived these data by applying a methodology to estimate the quantity of dioxins contained in BR waste streams. (Note: We converted the BR quantities (pounds) of dioxin to grams (using 454.5 grams per pound) and rounded these quantities to the nearest whole gram). The estimates of dioxins contained in hazardous wastes supplement the data reported to TRI, providing a broader perspective regarding the industries that generate and manage wastes that contain dioxins. Based on applying our methodology to the 2007 BR data, we estimate that 100 facilities in 37 NAICS codes reported hazardous wastes containing approximately 128 grams of dioxins. Two facilities in NAICS code 332722 (Bolt, Nut, Screw, Rivet, and Washer Manufacturing) accounted for approximately 42 percent of the total estimated quantity of dioxins in the hazardous waste streams (Exhibit 4.13).

Exhibit 4.13. Estimated Quantity of Dioxins in Primary Generation Hazardous Waste for Facilities Reporting 95 Percent of the Total Priority Chemical Quantity, by NAICS Code (2007)

Primary NAICS Code	NAICS Code Description	Number of Facilities	Quantity (grams) of Dioxins*			Percent of Total Quantity
			Wastewaters	Non-Wastewaters	Total Quantity	
332722	Bolt, Nut, Screw, Rivet, and Washer Manufacturing	2	0.00	53.89	53.89	42.0%
325510	Paint and Coating Manufacturing	1	0.00	31.26	31.26	24.4%
481111	Scheduled Passenger Air Transportation	1	13.88	0.00	13.88	10.8%
337122	Nonupholstered Wood Household Furniture Manufacturing	1	0.00	9.62	9.62	7.5%
621491	HMO Medical Centers	1	0.00	5.49	5.49	4.3%
321114	Wood Preservation	25	2.10	2.81	4.91	3.8%
611310	Colleges, Universities, and Professional Schools	23	0.00	2.67	2.67	2.1%
	Total	**54**	**15.98**	**105.75**	**121.73**	**94.9%**

In 2007, facilities generated hazardous waste containing dioxins in 87 counties within 39 states and territories. Exhibit 4.14 shows the nine counties in which facilities generated an estimated 96 percent of the dioxins contained in hazardous wastes.

Exhibit 4.14. States and Counties in Which Facilities Generated 96 Percent of Dioxins Contained in Primary Generation Hazardous Waste (2007)

EPA Region	State	County	Estimated Quantity of Dioxins Contained in Hazardous Wastes (grams)	Percent of Total Quantity of Dioxins Contained in Hazardous Wastes
9	CA	Los Angeles	53.91	42.0%
3	PA	Fayette	31.26	24.4%
9	CA	San Francisco	13.88	10.8%
2	NJ	Passaic	9.62	7.5%
5	MN	Hennepin	5.49	4.3%
4	AL	Shelby	2.55	2.0%
8	CO	Larimer	2.18	1.7%
4	MS	Stone	2.01	1.6%
9	CA	Ventura	1.89	1.5%
		Total	**122.79**	**95.7%**

Exhibit 4.15 shows how facilities reported managing hazardous wastes that contain dioxins. For example, facilities used fuel blending for hazardous wastes containing an estimated 46 grams of dioxins and transferred off site (for storage/bulking) an estimated 33 grams of dioxins contained in hazardous wastes. See Appendix E for a full list of the BR management codes and their descriptions.

Exhibit 4.15. Methods Used to Manage Hazardous Wastes Containing 99 Percent of the Estimated Quantity of Dioxins (2007)

Management Method Group	Management Method Code Description	Quantity (grams) of Dioxins Managed (2007)	Percent of Total Estimated Quantity of Dioxins
Reclamation and Recovery	Fuel blending prior to energy recovery at another site	46.05	35.8%
	Solvents recovery	14.51	11.3%
	Energy recovery at this site	13.92	10.8%
	Metals recovery	2.68	2.1%
	Other recovery or reclamation for reuse	0.22	0.2%
	Reclamation and Recovery Total	**77.38**	**60.2%**
Transfer Off Site	Storage, bulking, and/or transfer off site	33.37	25.9%
	Transfer Off Site Total	**33.37**	**25.9%**
Disposal	Landfill or surface impoundment that will be closed as landfill	8.72	6.8%
	Discharge to sewer/POTW or NPDES	2.08	1.6%
	Disposal Total	**10.80**	**8.4%**
Destruction or Treatment Prior to Disposal at Another Site	Incineration	6.66	5.2%
	Sludge treatment and/or dewatering	0.19	0.1%
	Neutralization only	0.14	0.1%
	Destruction or Treatment Prior to Disposal at Another Site Total	**6.99**	**5.4%**
NA	NA	0.1	0.1%
	NA Total	**0.1**	**0.1%**
	Grand Total	**128.64**	**100.0%**